Dataset Expocode	**BMBE20120418**
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Dataset	**Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program **Initial Submission (yyyymmdd):** 20160613 **Revised Submission (yyyymmdd):** 20160613
Campaign/Cruise	**Expocode:** BMBE20120418 **Campaign/Cruise Name:** BarX20120418 **Campaign/Cruise Info:** AOML_SOOP_CO2 **Platform Type:** **CO2 Instrument Type:** Equilibrator-IR or CRDS or GC **Survey Type:** SOOP Line **Vessel Name:** Barcelona Express **Vessel Owner:** Anglo Eastern Ship Management **Vessel Code:** BMBE
Coverage	**Start Date (yyyymmdd):** 20120418 **End Date (yyyymmdd):** 20120514 **Westernmost Longitude:** 97.7 W **Easternmost Longitude:** 9.2 E **Northernmost Latitude:** 38.9 N **Southernmost Latitude:** 19.2 N **Port of Call:** Cagliari, Italy **Port of Call:** Leghorn, Italy **Port of Call:** Genoa, Italy **Port of Call:** Barcelona, Spain **Port of Call:** Valencia, Spain **Port of Call:** Port Everglades, FL, USA **Port of Call:** Veracruz, Mexico **Port of Call:** Altamira, Mexico **Port of Call:** Houston, TX, USA **Port of Call:** New Orleans, LA, USA
Variable	**Name:** xCO2_EQU_ppm **Unit:** ppm **Description:** Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Variable	**Name:** xCO2_ATM_ppm **Unit:** ppm **Description:** Mole fraction of CO2 measured in dry outside air (ppm)
Variable	**Name:** xCO2_ATM_interpolated_ppm **Unit:** ppm **Description:** Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)
Variable	**Name:** PRES_EQU_hPa **Unit:** hPa **Description:** Barometric pressure in the equilibrator headspace (hPa)
Variable	**Name:** PRES_ATM@SSP_hPa **Unit:** hPa **Description:** Barometric pressure measured outside, corrected to sea level (hPa)
Variable	**Name:** TEMP_EQU_C **Unit:** Degree C **Description:** Water temperature in equilibrator (°C)
Variable	**Name:** SST_C **Unit:** Degree C **Description:** Sea surface temperature (°C)
Variable	**Name:** SAL_permil **Unit:** ppt **Description:** Sea surface salinity on Practical Salinity Scale (o/oo)
Variable	**Name:** fCO2_SW@equT_uatm **Unit:** µatm **Description:** Fugacity of CO2 in sea water at equilibrator temperature and 100% humidity (µatm)
Variable	**Name:** fCO2_ATM_interpolated_uatm **Unit:** µatm **Description:** Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)
Variable	**Name:** dfCO2_uatm **Unit:** µatm **Description:** Sea water fCO2 minus interpolated air fCO2 (µatm)
Variable	**Name:** WOCE_QC_FLAG **Unit:** None **Description:** Quality control flag for fCO2 values (2=good, 3=questionable)
Variable	**Name:** QC_SUBFLAG **Unit:** None **Description:** Quality control subflag for fCO2 values, provides explanation when QC flag=3
Sea Surface Temperature	**Location:** In ship's engine room at a side port off the piping carrying cooling water for the engines. Between the sea chest and the side port there is ~5 meters of pipe (~0.25 diameter). During the transit, the seawater warms an estimated 0.2-0.5 deg C. The reported SST is the value measured at the side port. **Manufacturer:** Seabird **Model:** SBE 38

	Accuracy: 0.001 (°C if units not given) **Precision:** 0.0003 (°C if units not given) **Calibration:** Factory calibration **Comments:** Manufacturer's Resolution is taken as Precision.
Sea Surface Salinity	**Location:** In the ship's engine room next to CO2 system. **Manufacturer:** Seabird **Model:** SBE 45 **Accuracy:** ± 0.005 o/oo **Precision:** 0.0002 o/oo **Calibration:** Factory calibration **Comments:** Manufacturer's Resolution is taken as Precision.
Atmospheric Pressure	**Location:** On deck above bridge at ~20 m above sea surface. **Normalized to Sea Level:** yes **Manufacturer:** Druck **Model:** RPT350 **Accuracy:** ± 0.08 hPa (hPa if units not given) **Precision:** 0.01 hPa (hPa if units not given) **Calibration:** Factory calibration **Comments:** Manufacturer's Resolution is taken as Precision.
Atmospheric CO2	**Measured/Frequency:** Yes, 5 readings in a group every ~4.5 hours **Intake Location:** On mast above the bridge at ~20 meters above the sea surface **Drying Method:** Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry). **Atmospheric CO2 Accuracy:** ± 0.5 µatm in fCO2_ATM **Atmospheric CO2 Precision:** ± 0.01 µatm in fCO2_ATM
Aqueous CO2 Equilibrator Design	**System Manufacturer:** **Intake Depth:** 5 meters **Intake Location:** Bow **Equilibration Type:** Spray head above dynamic pool, with thermal jacket **Equilibrator Volume (L):** 0.95 L (0.4 L water, 0.55 L headspace) **Headspace Gas Flow Rate (ml/min):** 70 - 150 ml/min **Equilibrator Water Flow Rate (L/min):** 1.5 - 2.0 L/min **Equilibrator Vented:** Yes **Equilibration Comments:** Primary equilibrator is vented through a secondary equilibrator. **Drying Method:** Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
Aqueous CO2 Sensor Details	**Measurement Method:** IR **Method details:** details of CO2 sensing (not required) **Manufacturer:** LI-COR **Model:** 840 **Measured CO2 Values:** xCO2(dry) **Measurement Frequency:** Every 140 seconds, except during calibration **Aqueous CO2 Accuracy:** ± 2 µatm in fCO2_SW **Aqueous CO2 Precision:** ± 0.01 µatm in fCO2_SW **Sensor Calibrations:** **Calibration of Calibration Gases:** The analyzer is calibrated every ~4.5 hours using ESRL standards that are directly traceable to the WMO scale. Ultra-High

Purity air (0.0 ppm CO2) and the high standard (when both present) are used to zero and span the LI-COR analyzer.
Number Non-Zero Gas Standards: 4
Calibration Gases:

Std 1: CA06827, 284.71 ppm, owned by ESRL, used every ~5.0 hours.
Std 2: CA06368, 328.12 ppm, owned by ESRL, used every ~5.0 hours.
Std 3: CA03910, 372.81 ppm, owned by ESRL, used every ~5.0 hours.
Std 4: CC71588, 531.98 ppm, owned by ESRL, used every ~5.0 hours.
Std 5: 0.00 ppm, owned by AOML, used every ~25.5 hours.
Comparison to Other CO2 Analyses:
Comments: Instrument is located below a walkway in the engine room.
Method Reference:
Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Equilibrator Temperature Sensor

Location: Inserted into equilibrator ~5 cm below water level
Manufacturer: Hart
Model: 1521
Accuracy: 0.025 (°C if units not given)
Precision: 0.001 (°C if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Equilibrator Pressure Sensor

Location: Inside LICOR connected to ambiant air. The differential pressure reading from A Setra 239, which is attached to the equilibrator headspace, is added to the pressure reading from the LICOR analyzer.
Manufacturer: Licor
Model: 840-P
Accuracy: 15 (hPa if units not given)
Precision: 1 (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Additional Information

Suggested QC flag from Data Provider: NA
Additional Comments: This cruise had a lot of issues: First, it seems that the seawater was being recirculated because both equ temp and SST showed very regular spikes of about 3°C. Also, the SST sometimes diverged from the equ temp and recorded higher values than equ temp. For that reason, SST was not used and was replaced by equ temp. The fugacity values are therefore reported at equ temp. The SSS values might have issues as well but the effect on the calculations of fCO2 being minimal, the SSS values have not been flagged.As with previous voyages, the atm P also shows spikes of ~ 10 mbar, probably due to water in the line. Went back to 2010 cruises and determined offset between equ P and NCEP R2 . for BarX20101014: amP = equP + 2.47 (+/- 1.45) mbar over the whole cruise. for BarX20101202: amP = equP + 2.67 (+/- 2.07) mbar over the whole cruise. Applied +2.60 to equP to generate atmP. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/barcelona/barcelona_introduction.html
Citation for this Dataset:
Other References for this Dataset: